IDENTIFYING MULTIPLE BONDS IN POLYATOMIC MOLECULES

- Like diatomic molecules, polyatomic molecules can contain double or triple bonds
- To identify multiple bonds, we can draw electron-dot configurations around atoms in molecules and figure out whether they have an octet

POLYATOMIC MOLECULES CONTAINING ELEMENTS BELOW THE SECOND ROW

- Elements below the 2nd row and on the right side of the periodic table have a tendency to not follow the octet rule
    - They are larger and can fit more than 4 atoms around them
    - They contain empty d-orbitals in the valence shell

GENERAL RULES FOR DRAWING MOLECULAR STRUCTURES

- Step 1: Find the total number of valence electrons for ALL atoms
    - If molecule is an anion, ann electrons to account for charge; for cations, subtract electrons to account for charge
- Step 2: Decide how atoms should be connected, and draw lines to indicate these bonds (each bond = 2 electrons)
    - Sometimes, connectivity is given, sometimes, you have to decide
        - Hydrogens and halogens usually only form one bond
        - 2nd row elements usually form number of bonds given in table 7.3
        - 3rd row and higher elements are often the central atom around which the other atoms are arranged
        - Another way to double check: Central atom usually has the lowest EN
- Step 3: Assign electrons to the terminal atoms
    - subtract the number of electrons used for bonding from the total number of valence electrons calculated in step 1
    - Finish the octet of all terminal atoms by adding lone pairs (except for H, which does not form an octet)
    - Subtract the number of electrons used to finish the octet from the number of electrons left in step 3
- Step 4: If step 3 left residual electrons, pace them on the central atom as lone pairs
- Step 5: If step 3 did not leave residual electrons, but the central atom does not have an octet, convert lone pairs to bonding pairs

ELECTRON DOT STRUCTURES AND RESONANCE

- In some compounds, there are several equivalent bonds, one of which needs to be a multiple bond to give an octet to all atoms

- However, there is no way to decide which bond should be the multiple bond-they are equivalent
- It has been found that in such cases, all bonds are indeed equivalent, and the characteristics are between single and double (or double and triple) bond
    - E.g. bond length, bond strength, etc
    - Think of these bonds as having a partial bond order like 1.5
- Such structures need to be represented by several resonance structures, and the real structure is an average of these

FORMAL CHARGES

- We have talked about ions in chapter 6, and assigned them ionic charges
- Formal charges help identify the most reasonable resonance structures
    - Atoms with high EN are more likely to carry a negative charge
    - Separating charges cost energy